REMARKS

Claim 1 has been amended herein to clarify the inventive aspects of the present invention. Support for the proposed amendment can be found in, among other places, paragraph 9 and paragraph 155, lines 7-9 of the published specification. Applicant has addressed every ground for rejection in the Office Action dated December 10, 2008, and believes the application is now in condition for allowance. Accordingly, reconsideration of this application is respectfully requested. Additionally, Applicant herein respectfully requests an interview with the Examiner to discuss the merits of the case.

I. The claims of the present application to not claim the same invention as U.S. Patent No. 5,774,514.

Claims 1, 2, 4-6, 8, 9, 12, 17, 19-22, 24, 25, 28, 31 and 32 stand rejected under 35 U.S.C. 101 as claiming the same invention as that of Claims 1-33 of prior U.S. Patent No. 5,774,514. Claims 1, 2, 4-6, 8, 9, 12 and 17 have been cancelled and claims 19-22, 24, 25, 28, 31 and 32 depend from Claim 17. Accordingly, only Claim 17 will be address herein. For the reasons set forth below, it is respectfully submitted that Claim 17 of the present application and claim 1 of US Patent 5774514 (hereinafter "US '514") do not claim the same invention.

In order for a same invention double patenting invention to be proper, the same invention must be claimed twice. MPEP Section 804. One test to determine whether the same invention is being claimed twice is to determine whether a claim in the application or patent that could be literally infringed without infringing the other. Id. (citing *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970)). If it can, as is clearly demonstrated in the present case, a double patenting invention is improper.

The claims of US Patent 5774514 do not claim the following features of claim 17:

- A method of producing a useful short lived radioisotope for medical or industrial applications;
- recovering said useful radioisotope from the exposed material for use in medical or industrial application.

There is no discussion in US '514 of the production of useful short lived radioisotopes, nor the recovery of such radioisotopes for use in medical or industrial applications.

The claims of US '514 also do not claim:

- Distributing a material containing said first isotope throughout the whole volume of an activation region made of heavy elements including lead or bismuth.

The examiner claims that the activation region reads on item 123 of Figure 20 and item 128 of Figure 21. It is submitted however that region 123 of Figure 20 cannot constitute an activation region in the context of the present invention since there is no radioactive material (fuel or waste) distributed within the entire volume of this region as required by the claim. The lead of region 123 acts as a coolant surrounding the core.

It is further submitted that item 128 is not made of lead and/or bismuth as required by the claim, and thus cannot constitute an activation region made of lead or bismuth in which radioactive waste is distributed. There is no clear disclosure that molten lead of region 123 passes through the region 128.

Region 129 cannot be read on the activation region of claim 17 since there is no radioactive material (fuel or waste) distributed within this region as required by the claim.

The combination of regions 128 and 129 cannot equate to an activation region in the context of claim 17 since the entire 128/129 region is not made of lead and/or bismuth because region 128 is not made of this material. Moreover radioactive material is not distributed throughout the entire volume of the combined region since there is no radioactive material in the 129 region. Thus the combined region of regions 128 and 129 does not equate an activation region made of heavy elements including at least one of lead/and or bismuth having a distribution of a material containing a first isotope.

Fuel material is arranged in a region outside the lead. It is clearly stated in paragraph 155, lines 7-9 of the published present application that the material to be exposed to the neutron flux **must be finely distributed over the whole volume of the Activation region**. Thus, nuclear fuel being located in a separate region to a region of

molten lead does not equate to material being located in a dispersed for throughout the whole volume of the activation region.

Distribution of the first isotope material in an activation region made of lead and/or bismuth constitutes an essential feature of the invention since it is the neutron capture interactions taking place in this medium that lead to the production of the short lived useful radioisotope. Moreover the importance of the radioactive material being distributed throughout the whole volume is set out in paragraphs 156 and 157 of the published application (i.e., to make use of the whole flux; and to avoid self screening).

Similarly, claim 17 of the present application does not claim all the features of the claims of US'514. In particular:

- The method of claim 17 does not produce energy from a nuclear fuel material including a fertile element (a fertile element being an element for producing a fissile element for nuclear fission). A first radioisotope for producing a useful short-lived radioisotope cannot be considered to constitute a fertile element in the context of the claims of US'514 since it does not produce a fissile element for nuclear fission. A short-lived radioisotope does not constitute a fissile element in the context of US'514.
- Claim 17 does not include the step of the sub-critical process of breeding of a fissile element from the fertile element. There is no discussion in the description of the interaction of fertile element leading to a fissile element via a β-precursor which is an essential step of the invention of US'514 since the claims of US'514 are directed to a method of producing energy.
- Claim 17 does not define the step of recovering thermal energy from a sub-critical breeding and fission process which is another essential step of the invention of US'514 since the claims are directed to a method of producing energy. In the present application (page 80, lines 27-30), it is clearly stated that no appreciable heat is produced in the transmutation process of the present application.

On the basis of the above, claim 17 of the present application does not define the same invention as claim 1 of US '514, and vice versa. Accordingly, it is respectfully submitted that the rejection is traversed and should be withdrawn.

II. The claims of the present application to not claim the same invention as U.S. Patent Application No. 10/985,323.

Claims 1, 2, 4-6, 8, 9, 12, 17, 19-22, 24, 25, 28, 31 and 32 stand provisionally rejected under 35 U.S.C. 101 as claiming the same invention as that of Claim 49 of prior copending application serial No. 10/985,323. Claims 1, 2, 4-6, 8, 9, 12 and 17 have been cancelled and claims 19-22, 24, 25, 28, 31 and 32 depend from Claim 17. Accordingly, only Claim 17 will be address herein. For the reasons set forth below, it is respectfully submitted that Claim 17 of the present application and claim 49 of US Patent Application 10/985,323 do not claim the same invention.

Claim 17 does not claim the following features of claim 49 of US 10/985,323:

- transmuting at least one long-lived isotope of fission fragment radioactive waste; and
- distributing a material containing one long lived isotope of fission fragment radioactive waste throughout the whole volume of the activation region.

Similarly claim 49 of US 10/985323 does not claim:

- a method of producing a useful short lived radioisotope for medical or industrial applications;
- recovering said useful radioisotope from the exposed material for use in medical or industrial application.

On this basis, the claims related to two distinct inventions. Accordingly, it is respectfully submitted that the rejection is traversed and should be withdrawn.

III. The claims are not anticipated by *Bowman*.

Claims 1, 2, 4-6, 8, 9, 12, 17, 19-21, 24, 25 and 28 stand rejected under 35 U.S.C. 102(b) as being anticipated by *Bowman* (5,160,696). For the reasons set forth below,

among others, it is respectfully submitted that *Bowman* does not disclose the following feature of claim 17:

- distributing a material containing a first isotope throughout the whole volume of an activation region made of lead and/or bismuth.

Radioactive material is not distributed in the lead-bismuth target enclosure 84 of Figure 4, thus no region of enclosure 84 constitutes an activation region in the context of claim 49.

It is maintained that the molten salt recirculation loop cannot be considered to be an activation region in the sense of claim 17 since this region is not made of lead or bismuth. Contrary to the interpretation of the Examiner as outlined in pages 14 and 15 of the office action, it is resubmitted that the molten salt in the molten salt recirculation loop does NOT contain lead or bismuth, and thus the fission product bundle in loop 94 does not constitute a distribution of isotope in an activation region.

Col. 8 lines 13-16 refers firstly to a lead-bismuth molten salt target (i.e. target region 84 of Figure 4); and secondly to a surrounding blanket of molten salt containing fissionable material. There is no mention in the document that the molten salt blanket contains lead or bismuth, only the target area is referred to as containing lead-bismuth, and this target area does not contain any isotopes as required by claim 17.

Moreover, col. 11, lines 12-14 refers to a lead bismuth eutectic mixture liquid-metal spallation target. Again this refers to target region 84 and not to the material of the surrounding molten salt recirculation loop. It is clearly stated that the molten salt eutectic in the recirculation loop may contain LiF (Lithium Fluoride), BeF_2 (Beryllium Fluoride), UF_4 (uranium tetrafluoride). There is no mention of any compound containing lead (Pb) or Bismuth (Bi) making up the molten salt for recirculation loop 84. Moreover the molten lead salt of device 84 and salt recirculation loop 94 do not intermix. There is clearly a Pb-Bi heat exchanger for enclosure 84 and a MS (molten salt) heat exchanger for loop 94.

Consequently, *Bowman* does not disclose:

- neutron capture efficiency in the material being enhanced by resonance neutron capture.

This is because region 84 where radioactive material is present does not contain lead or bismuth. Lead and Bismuth exhibit characteristics which enable the technical effects to be achieved by elastic scattering and the resultant progressive decrease in energy. Both Lead and Bismuth have a small neutron capture cross section compared to their neutron elastic scattering cross section. In the case of Lead the neutron scattering cross section is approximately 11 barns while the neutron absorption cross section is 0.0048 barns. In the case of Bismuth the neutron scattering cross section is approximately 9 barns while the neutron absorption cross section is 0.034 barns. This enables a high proportion of elastic scattering. Both Lead and Bismuth or a mixture thereof have a lethargy (fractional average energy loss at each neutron elastic collision) to the order of 9.54 10-3 (see page 3, line 30 to page 4, line 7 of the present application). In contrast, the molten salt region of *Bowman* does not exhibit these properties which lead to the required progressive loss of neutron energy.

Bowman also does not disclose:

- A method of producing a useful short-lived radioisotope for medical or industrial applications;
- recovering said useful radioisotope from the exposed material for use in medical or industrial application.

Since *Bowman* does not disclose each of the features of claim 17, it is submitted that claim 17, and those claims depending therefrom, are novel with respect to Bowman. Therefore, it is respectfully submitted that the rejection is traversed and should be withdrawn.

IV. The claims are not anticipated by *Venneri*.

Claims 1 and 17 stand rejected under 35 U.S.C. 102(b) as being anticipated by Venneri et al. U.S. Patent No. 5,160,696. For the reasons set forth below, among others, it is respectfully submitted that *Venneri* does not disclose the following features of claim 17:

- A method of producing a useful short-lived radioisotope for medical or industrial applications;

- recovering said useful radioisotope from the exposed material for use in medical or industrial application. There is no mention of the recuperation of useful short-lived radioisotopes for medical or industrial applications.
- the neutron source and an inner buffer region being devoid of a first target isotope.

Instead, in *Venneri*, the actinides are dissolved in the liquid lead target 22. There is no area devoid of target isotopes through which neutrons may travel before reaching an activation region.

In the present application, the importance of the target isotope to be activated not being present in the core is outlined in par 124; namely, that activation of the target isotope would be lower if the isotope to be activated were inserted into the cores since the neutron flux in this region is concentrated at energies in which captures by the long-lived FFs have a very tiny cross section. In *Venneri,* since the material to be transmuted are actinides which are fissionable under high energy neutrons, it is important that the material is present in the core for an increased transmutation rate, and that the neutrons do not pass through a region where they undergo a first reduction by inelastic scattering before reaching the material to be transmuted. *Venneri* clearly states in col.5, line 33, that there is no attempt to moderate neutrons in the fast neutron spectrum system based on liquid lead and that fast neutrons are supplied for utilisation in a uranium enrichment blanket surrounding the system at the expense of radioactive waste in the burn apparatus.

Furthermore, *Venneri* does not disclose or teach neutron capture efficiency being increased by in neutron capture in resonance spectrum of a target isotope. Since *Venneri* deals with actinides fissionable under fast neutrons, the issue of resonance cross section of fission fragment material at lower neutron energies is not relevant.

Since *Venneri* does not disclose each of the features of claim 17, claim 17 is novel with respect to *Venneri*. Therefore, it is respectfully submitted that the rejection is traversed and should be withdrawn.

V. Claims 6, 21-22 are not obvious over the prior art.

Claims 6, 21-22 stand rejected under 35 U.S.C. 103(a) as being unpatentable over *Bowman* as applied to claims 1, 2, 4-6, 8, 9, 12, 17, 19-20, 24, 25 and 28 above and further in view of *Borst* (3,197,375). For the reasons set forth above with respect to Claim 17, it is respectfully submitted that Claims 21 and 22 are both novel and inventive.

VI. Claims 31-32 are not obvious over the prior art.

Claims 31-32 stand rejected under 35 U.S.C. 103(a) as being unpatentable over *Bowman* as applied to claims 1, 2, 4-6, 8, 9, 12, 17, 19-20, 24, 25 and 28 above and further in view of *Ruddock* (4,123,497). For the reasons set forth above with respect to Claim 17, it is respectfully submitted that Claims 31 and 32 are both novel and inventive.

VII. Claim 17 is not obvious over the prior art.

Claims 1 and 17 stand rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. 5,160,696 to *Bowman* in view of U.S. 6,442,226 to *Venneri*. Claim 1 has been cancelled. For the reasons set forth herewithin, it is respectfully submitted that combining the teaching of *Bowman* with *Venneri* will not lead to the invention of claim 17 since the combination of the documents does not disclose all the features of claim 17.

The feature of distributing a first target isotope throughout the whole volume of an activation region is not disclosed in *Bowman*. *Venneri* does not teach towards or disclose the missing feature. *Venneri* would instead teach the skilled person to place actinides throughout the volume of enclosure 84, thereby teaching away from the invention of providing a neutron source and a surrounding inner buffer region devoid of a first target isotope.

Moreover, neither document discusses exploiting the increased neutron capture in the resonance spectrum of a first target isotope to enhance neutron capture efficiency. Consequently the combined teaching of *Venneri* and *Bowman* does not lead to claim 17.

VIII. Claims 1 and 17 are not obvious over Stanton in view of *Venneri.*

Claims 1 and 17 stand rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. 3,349,001 to *Stanton* in view of U.S. 6,442,226 to *Venneri*. As set forth above, Claim 1 has been cancelled. For the reasons set forth herewithin, it is respectfully submitted that claim 17 is patentable over these references.

Stanton does not disclose the following features of claim 17:

- distributing a material containing a first target isotope throughout the whole volume of an activation region made of lead and/or bismuth, said activation region surrounding a buffer region and target devoid of said first target isotope.

Combining the teaching of *Stanton* with *Venneri* will not lead to the invention of claim 17 since the feature of distributing the first target isotope throughout the whole volume of an activation region is not disclosed in *Venneri*. *Venneri* would teach the skilled person to place actinides throughout the volume of enclosure 84, thereby teaching away from the invention of providing a neutron source and a surrounding inner buffer region devoid of the target isotope.

Neither document discusses exploiting the increased neutron capture in the resonance spectrum of a first target isotope to enhance neutron capture.

Consequently the combined teaching of *Stanton* and *Venneri* does not lead to claim 17.

Should the Examiner discover that there are remaining issues, Applicant herein respectfully requests a telephonic interview with the Examiner to further discuss this application.

Respectfully submitted,

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